CleanAir

CASE STUDY

CTI Pitot Study

Background

Water flow rate is a critical rating parameter for cooling towers, pumps and condensers. Since its inception in 1959, the Cooling Technology Institute (CTI) has used Simplex-type pitot tubes for the measurement of water flow rate. The Simplex tube is no longer commercially available and results were suspect in challenging flow situations.

CleanAir's Approach

CleanAir was retained by CTI to investigate alternative pitot designs. Two candidate designs, an elliptical pitot and a modified Fechheimer Pitot, were designed and built for the study. The pitot tubes were evaluated in controlled hydraulic laboratories and contrasted to the Simplex Pitot Tube. Within the laboratories, the tubes were evaluated in disturbed flow profiles and various pipe diameters. The sensitivity of the tubes to Reynolds numbers was evaluated by changing the bulk fluid temperature and velocity.

Results

Based on the results of this study, CleanAir recommended that the elliptical pitot design be adopted as the new standard measurement device for water flow measurements. The justifications for this recommendation include:

- The flow measurements made with the elliptical pitot tube are much less sensitive to flow disturbances than the Simplex Pitot Tube. The sensitivity to flow disturbance is similar to that of the Fechheimer Pitot Tube.
- The tip design of the elliptical pitot tube permits measurements closer to the pipe wall than the Fechheimer Pitot tTube.
- The pitot coefficient for the elliptical pitot tube showed a very low dependence on the Reynolds number. This is a very desirable characteristic, because it reduces the number of calibration points required to determine accurately the Reynolds number dependent pitot coefficient.
- The coefficient determined at each Reynolds number had the least deviation from the Reynolds number dependent calibration curve for the elliptical pitot tube, as compared to the other pitot tubes.

Summary

The new pitot design is being adopted by CTI for all cooling tower tests, including thermal performance, drift emissions, plume abatement, and sound tests. The new design is expected to provide more accurate flow determinations especially when the flow profile is disturbed.